

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) An apparatus for channel estimation ~~of~~ in a communication device ~~with having~~ a transmit path and a receive path both coupled to a communication medium, and the apparatus comprising:

~~a pseudo-random noise generator (PRN) coupled to the transmit path for periodically to injecting a codeword signal into the transmit path which effects both a leakage signal on the receive path as well as reflected signals from various portions of the communication medium;~~

~~an analog-to-digital converter coupled to the receive path to digitize a composite received signal including both the leakage signal and the reflected signals; and~~

~~a correlator coupled to the receive path to correlate delays between the leakage signal and each of the reflected signals to estimate channel characteristics for the communication medium—to generate an ordered set of correlation coefficients corresponding with successive phasings of the codeword with respect to a received signal, and the correlator including:~~

- ~~• a detector to detect peaks within the ordered set of correlation coefficients including both a peak corresponding with a leakage signal together with at least one other peak corresponding to a reflection of the injected codeword by the communication medium, and the detector determining at least one of the offset between peaks or a relative magnitude of the peaks, thereby estimating the channel characteristics across the communication medium.~~

2. (Currently Amended) The apparatus of Claim 1, wherein ~~the codeword comprises a pseudo random sequence;~~ the correlator further comprises:

- a receive buffer for storing an interval of the received signal;
- a shifter for shifting the codeword with respect to the interval of the received signal in the receive buffer; and
- components for generating successive ones of the ordered set of correlation coefficients on each shift of the shifter.

3. (Canceled)

4. (Currently Amended) The apparatus of Claim 1, ~~wherein~~ further comprising:

- ~~the codeword comprises a pseudo random binary sequence consisting of a binary "1" and a binary "-1";~~ '+1's together with '-1's or '0's together with '1's; and
- a plurality of XOR gates each with an output and a pair of inputs a first of which pair of inputs couples to a corresponding bit of the codeword and a second of which pair of inputs couples to a corresponding sample of the received signal;
- a shifter to shift the codeword with respect to the corresponding samples of the received signal or vice-versa; and
- a summer coupled to the outputs of to each bit of the plurality of XOR gates to sum the outputs of the plurality of the plurality of XOR gates codeword on each shift of the shifter, thereby generating successive ones of the ordered set of correlation coefficients.

5. (Currently Amended) The apparatus of Claim 1, wherein ~~said generator comprises a digital signal processor;~~ the correlator further comprises:

- a codeword buffer for storing the codeword;
- a shifter for shifting an interval of the received signal with respect to the codeword stored in the codeword buffer; and
- components for generating successive ones of the ordered set of correlation coefficients on each shift of the shifter.

6-7. (Canceled)

8. (Currently Amended) The apparatus of Claim 1, wherein the ~~correlator~~ detector further comprises:

~~a logic for determining an ordered set of correlation coefficients for the codeword with respect to the composite received signal;~~

a peak detector for detecting peaks within the ordered set of correlation coefficients;

a leakage peak detector for determining which among the peaks detected by said peak detector corresponds with the leakage peak; and

a sequencer for sequentially ordering the peaks corresponding with a time of receipt of each of the reflected signals with respect to the peak corresponding with the time of receipt of the leakage signal to estimate channel characteristics for the communication medium.

~~10.~~ 9. (Currently Amended) The apparatus of Claim 1, wherein the communication medium comprises one of a wired and a wireless communication medium.

~~11- 10. (Currently Amended)~~ The apparatus of Claim 1, wherein the communication device comprises one of a physical modem and a logical modem.

~~12- 11. (Currently Amended)~~ The apparatus of Claim 1 wherein the communication device implements at least one X-DSL communication protocol.

~~13- 12. (Currently Amended)~~ A method for channel estimation in a communication device with having a transmit path and a receive path both coupled to a communication medium, and the method comprising the acts of:

periodically injecting a pseudo-random codeword signal into the transmit path of the communication device which effects both a leakage signal on the receive path as well as reflected signals from various portions of the communication medium;

digitizing a composite received signal including both the leakage signal and the reflected signals; and

correlating delays between the leakage signal and each of the reflected signals to estimate channel characteristics for the communication medium;

generating from the receive path an ordered set of correlation coefficients corresponding successive phasings of the pseudo-random codeword with respect to a received signal resulting from the injecting act;

detecting peaks within the ordered set of correlation coefficients including both a peak corresponding with a leakage signal together with at least one other peak corresponding to a reflection of the injected pseudo-random codeword by the communication medium; and

determining at least one of the offset between peaks or a relative magnitude of the peaks, thereby estimating the channel characteristics across the communication medium.

~~14. 13. (Currently Amended)~~ The method of Claim ~~13~~ 12, ~~wherein the codeword comprises a pseudo-random sequence.~~ further comprising:

- storing an interval of the received signal;
- shifting the pseudo-random codeword with respect to the interval of the received signal;
- generating a correlation coefficient responsive to the shifting act; and
- repeating the shifting and generating acts to obtain the ordered set of correlation coefficients.

~~15. 14. (Currently Amended)~~ The method of Claim ~~13~~ 12, ~~wherein the codeword comprises a pseudo-random sequence with an interval of pseudo-randomness greater in duration than a return time associated with a selected one of the reflected signals reflected from a furthest selected portion of the communication medium.~~ further comprising:

- storing the pseudo-random codeword;
- shifting an interval of the received signal with respect to the codeword;
- generating a correlation coefficient responsive to the shifting act; and
- repeating the shifting and generating acts to obtain the ordered set of correlation coefficients.

15. (Canceled)

~~17. 16. (Currently Amended)~~ The method of Claim ~~13~~ 12, ~~further comprising the acts of:~~

~~determining an ordered set of correlation coefficients for the codeword with respect to the composite received signal;~~

detecting peaks within the ordered set of correlation coefficients;

determining which among the peaks detected ~~by said peak detector~~ detected
in the detecting act corresponds with the leakage peak; and

sequentially ordering the peaks corresponding with a time of receipt of each of
the reflected signals with respect to the ~~peak corresponding with the time of receipt of~~
~~the leakage signal~~ to estimate channel characteristics for the communication medium.